REQUIREMENTS DEVELOPMENT AND MANAGEMENT
Process Guide

TABLE OF CONTENTS

Preface

The Requirements Development and Management process guide is intended for use as a reference guide for those individuals within Student Financial Assistance (SFA) with a need to develop and manage requirements.

This process guide is consistent with the Solution Life Cycle (SLC) guidelines, in that it is used as a framework, which incorporates processes from the Systems Acquisition Capability Maturity Model (SA – CMM). The processes used within this guide are also consistent with the requirements of the SFA Modernization Blueprint.

In this document references are made to the Configuration Management (CM) Process Guide and the System Acquisition Planning (SAP) Guide. (See the Technology Handbook for these documents).

1.0 INTRODUCTION

1.1 Requirements Development and Management Summary

The purpose of Requirements Development and Management (RDM) is to establish a common and clear definition of system requirements that is understood by the project team, end user, and the contractor team.

Requirements Development involves activities in which system high level (HL) requirements are decomposed into detailed low level (LL) requirements. Direct participation from the end user is often needed to ensure that system-level requirements are well understood.

Requirements Management involves establishing and maintaining agreement among the members of project team, the end user, and contractor team with respect to the system (both HL and LL) requirements. It also involves baselining the system requirements (both HL and LL) and controlling the subsequent requirements changes.

Requirements Development and Management begins with identification of a business need translated into business case facts followed by the development of verifiable requirements that are implemented and deployed. RDM continues through the Support phase until the system is retired.

The goals, as outlined by the Capability Maturity Model Level 2 Key Process Area of Requirements Development and Management are:
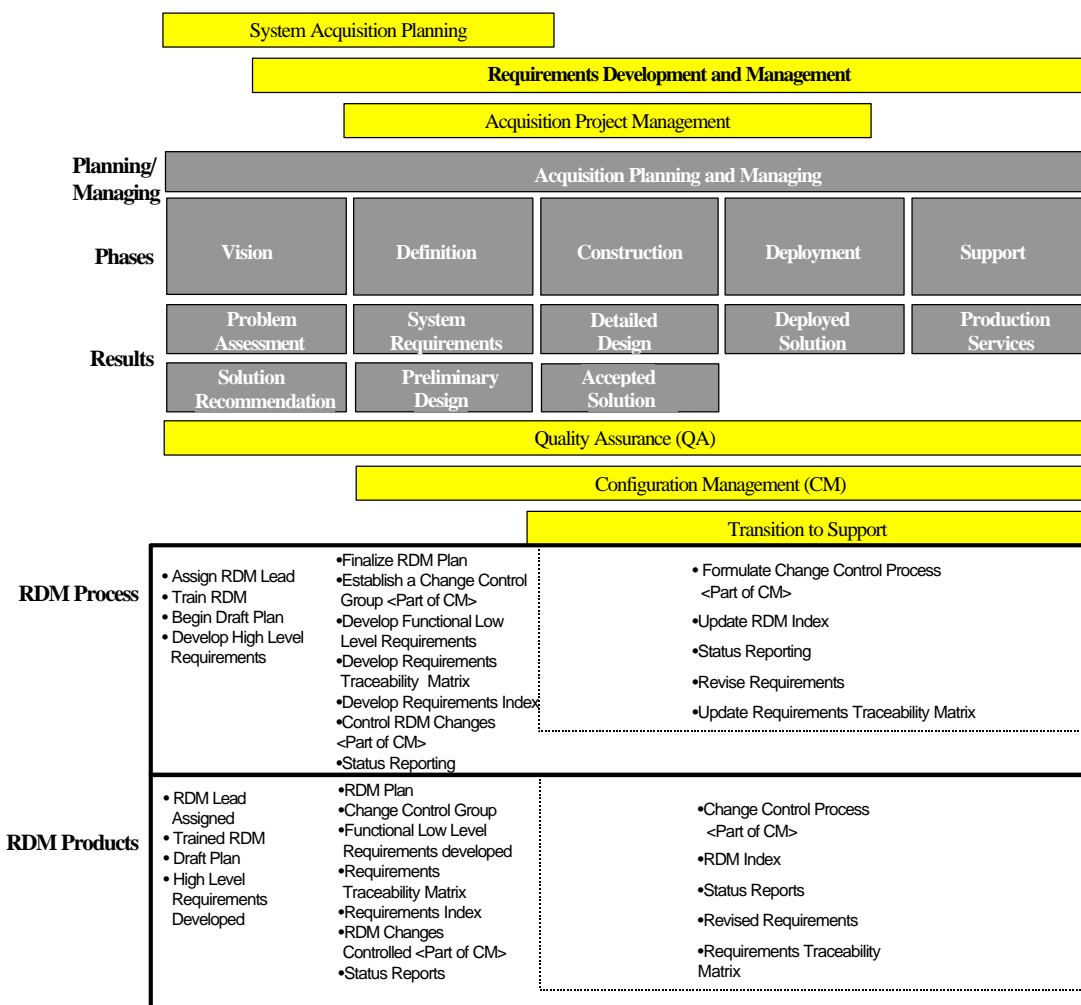- System requirements are developed, managed, and maintained.
- The end user and other affected groups have input to the system requirements over the life of the acquisition.
- System requirements are traceable and verifiable.
- The system HL requirements are baselined prior to the release of the solicitation package.
- Requirements are reviewed, agreed upon and approved.

1.2   Requirements Development and Management and the Solution Life Cycle (SLC)

Requirements Development and Management (RDM) outlines a series of processes for developing and managing system requirements. RDM refers to the processes, tools, and resources for establishing a common and clear definition of system requirements that is both understood and fully verifiable by the project team, end user, and the contractor team. Requirements Development is initiated during the Vision Phase to support System Acquisition Planning for the project.

Several System Acquisition RDM iterations are performed throughout the phases of the SLC. The following is a diagram and a description of Requirements Development and Management throughout the SLC:

	System Acquisition Planning				
	Requirements Development and Management				
	Acquisition Project Management				
Planning/ Managing	Acquisition Planning and Managing				
Phases	Vision	Definition	Construction	Deployment	Support
Results	Problem Assessment	System Requirements	Detailed Design	Deployed Solution	Production Services
	Solution Recommendation	Preliminary Design	Accepted Solution		
	Quality Assurance (QA)				
	Configuration Management (CM)				
	Transition to Support				
RDM Process	• Assign RDM Lead • Train RDM • Begin Draft Plan • Develop High Level Requirements	•Finalize RDM Plan •Establish a Change Control Group <Part of CM> •Develop Functional Low Level Requirements •Develop Requirements Traceability Matrix •Develop Requirements Index •Control RDM Changes <Part of CM> •Status Reporting	• Formulate Change Control Process <Part of CM> •Update RDM Index •Status Reporting •Revise Requirements •Update Requirements Traceability Matrix		
RDM Products	• RDM Lead Assigned • Trained RDM • Draft Plan • High Level Requirements Developed	•RDM Plan •Change Control Group •Functional Low Level Requirements developed •Requirements Traceability Matrix •Requirements Index •RDM Changes Controlled <Part of CM> •Status Reports	•Change Control Process <Part of CM> •RDM Index •Status Reports •Revised Requirements •Requirements Traceability Matrix		

At the Vision Phase of the SLC:

- **Assign RDM Lead**- An RDM lead is needed at the System Acquisition Planning level to lead the effort to develop and manage the project requirements. The RDM Lead has the responsibilities outlined below in Section 1.2.1, and in general to conduct the activities listed in this Process Guide.
- **Train RDM** - Assemble the necessary resources and personnel needed to establish the RDM Team and to carry out RDM. One suggested way to obtain necessary resources internally is to work with Human Resources Information Technology Representative or if applicable, do a query search within a skills database for the organization, searching for the individuals with a particular skill set that apply to RDM. The RDM Lead ensures support staff, project team members and affected users are familiar with their RDM roles and responsibilities. Also important to perform RDM effectively is an understanding of RDM policy, goals, and activities.

- **Begin a draft of the RDM Plan** - The draft of the RDM plan should include a general idea of resources needed for RDM planning and preparation. The RDM Plan should include a brief description of the following RDM processes for the project   The project manager will create the preliminary draft plan for requirements developing and managing. Each project should document a Requirements Development and Management (RDM) Plan as part of the Project Work Plan, even though specific RDM activities may not be known at the time. This plan will also include a schedule with estimated times on tasks that are performed for RDM. It is recommended the manager use the high level process flow to detail out the tasks and tasks activities related to developing requirements. This will allow the manager to better estimate the duration needed to complete a requirement development task. This same approach should be used for developing High and Low level requirements.
  (*Refer to Requirements Development and Management (RDM) Plan Template in the Appendix*)

  - ❑ Requirements Development and Management Identification (Identify work products, or RDM items essential to the project, such as plan template, requirements quality matrix, requirements documents, etc).

  - ❑ Requirements Development and Management Control (Change Control - the process of making change decisions) - *(Refer to the CM Process Guide).*

  - ❑ RDM Status Reporting (The administrative process for tracking and reporting of all RDM items).

  - ❑ RDM Baseline Requirements (the process of baselining requirements is to insure requirements are properly maintained and RDM policies and procedures are followed)

- **Develop High Level Requirements (HL)** - Capture the business requirements for the system. Working from initial guidance, determine what the acquisition system is supposed to do. Document each HL requirement, list them on the HL side of the traceability matrix and place the requirements under version control. As the requirements are modified and refined, keep a record of the previous versions.

At the Definition Phase of the SLC:

- **Finalize RDM Plan** - Update the Vision phase Draft RDM Plan and finalize before the Construction Phase. The RDM Plan is approved by the IPT Project Manager in conjunction with the sign-off of the Project Work Plan by the Executive Sponsor. The RDM plan must be maintained through the Support phase of the project life cycle. The RDM plan is a living document and represents the most up-to-date requirements development and management activities on a project. The RDM lead is responsible for maintaining the RDM plan. *(Refer to RDM Plan Template in the Appendix).*

- **Establish a Project Change Control Group (CCG)** – Work with Configuration Management Lead to establish a Project CCG. The Change Control group manages change and retains authority for deciding what proposed changes are incorporated in a work product, or RDM item. **(***Refer to CM Process Guide***)**

- **Develop Low Level (LL) Requirements** -Decompose the business requirements into low level requirements that can be used for solicitation or the basis for a contract. These requirements should be verifiable through testing.

- **Develop a Requirements Traceability Matrix-** Create a matrix to easily trace HL/LL requirements. User Needs are traced to business objectives and high-level functions to ensure they are supporting the objectives of the business and are within scope. Since User Needs define the basis for what the customer expects, requirements are traced back to User Needs at various states to ensure that they are within scope. As Requirements are baselined, they are traced forward to resulting work products as they are developed to ensure all baselined requirements are supported and that there are no work products developed that are out of scope. The examples in the appendix provide traceability mapping of requirements at various states. *(Refer to Traceability Matrix in the Appendix).*

- **Develop a Requirements Index** - Identify the location where requirements will be stored, e.g. a repository tool that will contain an index of all systems requirements each with a unique identification number. SFA recommends using Rational's Requisite Pro as a repository tool.

- **Control RDM Changes**- Establish a change control process and insure changes are baselined and stored in the traceability matrix. **(***Refer to CM Process Guide***).**

- **Status Reporting**- Administrative tracking and reporting of all RDM items - establish the standards for status reporting requirement developing and managing activities. This also involves establishing how often status reports are created, standard status reporting document used, and to whom the status report will be delivered.

At the Construction, Deployment, and Support Phases of the SLC:

- **Change Control Process**- Raise all desired changes to the CCG for resolution. *(*Refer CM *Process Guide***).**

- **Status Reporting**- Continue to perform administrative tracking and reporting of all RDM items. **(***Refer to CM Process Guide***)**

- **Revise Requirements -** All requirements must be revised when needed

- **Update Requirements Traceability Matrix** - Continue to update testing activities and functional requirements.

1.2.1   Assign Requirements Development and Management Roles

Identify and document roles and responsibilities within the RDM Plan template of the RDM process guide appendix. Also include roles and responsibilities recommended by the SLC for system development that apply to requirements development. The roles do not represent specific titles but they do identify the functional roles necessary to carry out RDM. The roles do not apply only to one person; one resource can perform multiple roles based on their competency. Below is the recommended list of roles that apply to RDM. Reference the Configuration Management (CM) Process guide for additional roles applied to controlling and managing requirements.

Project Sponsor (Executive Sponsor)
- Establishes the effort as a formal project (supports the request to proceed)
- Provides sponsorship for the project
- Agrees to and approves requirements
- Participates in periodic senior management reviews

Project Manager
- Establishes overall policy and direction for the RDM process
- Provides adequate resources for managing the RDM process
- Resolves outstanding issues with the Project Sponsor
- Represents the Project Sponsor
- Ensures that Project staff involved in RDM are properly trained
- Ensures that the User Needs are well defined
- Ensures that reviews are conducted
- Documents and resolves open Project issues
- Agrees to and approves requirements
- Reviews RDM process on a periodic and event-driven basis

IT Quality Assurance
- Ensures that agreed upon requirements are managed and controlled using the established CM procedures
- Ensures that approved requirements changes are incorporated into project plans, work products, and activities
- Documents and resolves open CIO IT issues
- Reviews RDM process on a periodic and event-driven basis

System Managers
- Represent existing applications in release management
- Review and approve requirements
- Address transition

RDM Team Lead
- Tailors RDM procedure for use on project if necessary
- Ensures CIO IT staff assigned RDM responsibilities are properly trained
- Ensures that reviews are conducted
- Leads the effort to develop the high level and low level requirements
- Records/updates requirements into the requirements database or source file
- Monitors, traces, and reports on requirements and Change Requests
- Coordinates communications between project team and User Representatives regarding system requirements throughout their project's system life-cycle
- Reviews and approves requirements

Contractor/SFA Responsibilities In RDM

New, replacement or major modification systems all begin in the Vision Phase. A vehicle for authorization to begin the definition of requirements in the Definition Phase is the Business Case. The SFA Modernization Blue Print and the Business Case both use multiple iterations of the High Level Requirements Process to create the facts necessary to validate the business need for the new, replacement, or major modification to a system. Once the Business Case (or other authorization such as the use of legacy maintenance funds) is approved the next major process is to develop the Low Level Requirements Process to explode the Business Case facts into further testable and/or verifiable technical and non-technical requirements. SFA validates its user acceptance testing by selecting certain high and low level requirements for specific testing. SFA, also, as part of user acceptance testing, reviews the documented high level to low level requirement development process as well as the code/test results to ensure that the contractor was diligent.

Traditional literature, to include the SA-CMM guide, assumes that the acquisition organization (i.e. SFA) will create the business case and the requirements followed by a solicitation using those requirements. In SFA, the arrival of the contractor is much earlier in the process. The contractor also is usually committed, on a contractual basis, to develop the functional requirements as the first phase of a multi-phased or multi-contract development effort. The primary responsibility for both the business case and the high level and low level requirements continues to rest with SFA since the combination of the two is a description of what SFA wants and verification that the contractor will deliver what is wanted.

Frequently SFA and the contractor enter into Integrated Product Teams (IPT's) and participate jointly in the development of these requirements. The primary responsibility of SFA remains to specify correctly what it wants, and that of the contractor to deliver what is requested by SFA. A particular responsibility is to avoid changing requirements "to include all of the functionality of the old system". Attention to these responsibilities can eventually reduce costs.

1.3   Process Guide Summary

1.3.1   *Guide Content*

This document describes the basic processes used in Requirements Development and Management:

High Level (HL) Requirements Development Process
This is the process of capturing the expressed desires of all stakeholders as part of a business case. The purpose of the HL process is to provide the factual basis that will allow senior management to decide whether or not to support the project. Once the project is approved the HL result becomes the starting point for developing the Low Level (LL) or contractual level of facts.

Low Level (LL) Requirements Development Process
This is the process of refining the high level requirements into a contractual level of detail. The contractual level of detail allows for future verification that the contractor has met the contractual specifications for the system.

Requirements Management Process
This is the process of managing the requirements development and maintenance effort. Although there are defined check points for the development of systems (such as at contract signature), there are changes that occur, and there is a management responsibility to ensure that all of the high level requirements have been fully translated into low level requirements. There is also a responsibility to insure that low level requirements that trace back to high level requirements are coded and tested. In a large project there will be a large number of both low and high level requirements.

Requirements Development and Management Appendix
This section contains various documents and or job aides that will aide the user through the development and management of the system requirements.

1.3.2   Using this Process Guide

This document is written to be a quick reference for three reader uses:
*   Building a Business Case
*   Developing Requirements For Building A New System
*   Doing System Change Requests On Legacy Or Completed Systems

Building a Business Case (Vision Phase)
The Systems Acquisition Planning Process Guide describes processes and procedures for developing a Business Case. In this RDM Process Guide, Section 2.2 **High Level (HL) Requirements Development Process** describes the RDM component for developing the business facts necessary to complete the Business Case. Whenever there are significant revisions to the HL Requirements Development Process then Section 3.0 Management Process can serve as a guide for those revisions.

Developing Requirements For Building A New System
Once a project is approved for definition or construction, the RDM attention shifts from the development of high level (HL) requirements to Section 2.3 **Low Level (LL) Requirements Development Process.** Whenever there are significant revisions to the LL Requirements Development Process then Section 3.0 Management Process can serve as a guide for those revisions. The Definition Phase of the Solutions Life Cycle (SLC) produces a set of testable or verifiable requirements that can be the basis of a solicitation or of construction/testing of a new system.

Doing System Change Requests On Legacy Or Completed Systems
Upon user acceptance, the system moves into a support or maintenance phase. Whenever there are changes envisioned for a system in production, Section 3.0 **Requirements Management Process** describes the RDM component for managing the change. The CM Process Guide describes processes and procedures for controlling change.
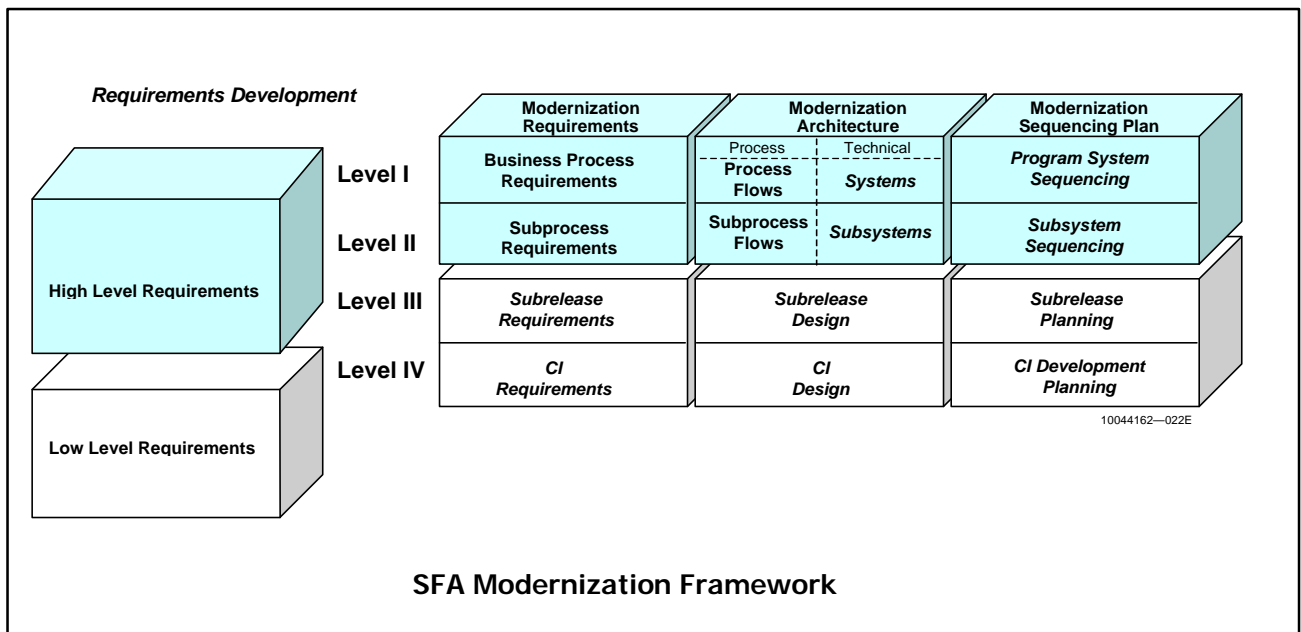
2.0 REQUIREMENTS DEVELOPMENT PROCESS

2.1 The SFA Modernization Blueprint and RDM

In the context of the architecture and framework of the SFA Modernization Blueprint are included Business Requirements, which are subdivided into four levels. These Business requirements map to the RDM requirements. The RDM high level requirements map to Modernization Blueprint Business Requirements levels 1-3, while the RDM low level requirements map to level 4. This document supports the development of requirements at levels 3 and 4, as shown in the diagram below.
For further detail, refer to the SFA Modernization Blueprint document.

Requirements Development		Modernization Requirements	Modernization Architecture		Modernization Sequencing Plan
High Level Requirements	Level I	Business Process Requirements	Process / Process Flows	Technical / Systems	Program System Sequencing
	Level II	Subprocess Requirements	Subprocess Flows	Subsystems	Subsystem Sequencing
	Level III	Subrelease Requirements	Subrelease Design		Subrelease Planning
Low Level Requirements	Level IV	CI Requirements	CI Design		CI Development Planning

10044162—022E

SFA Modernization Framework

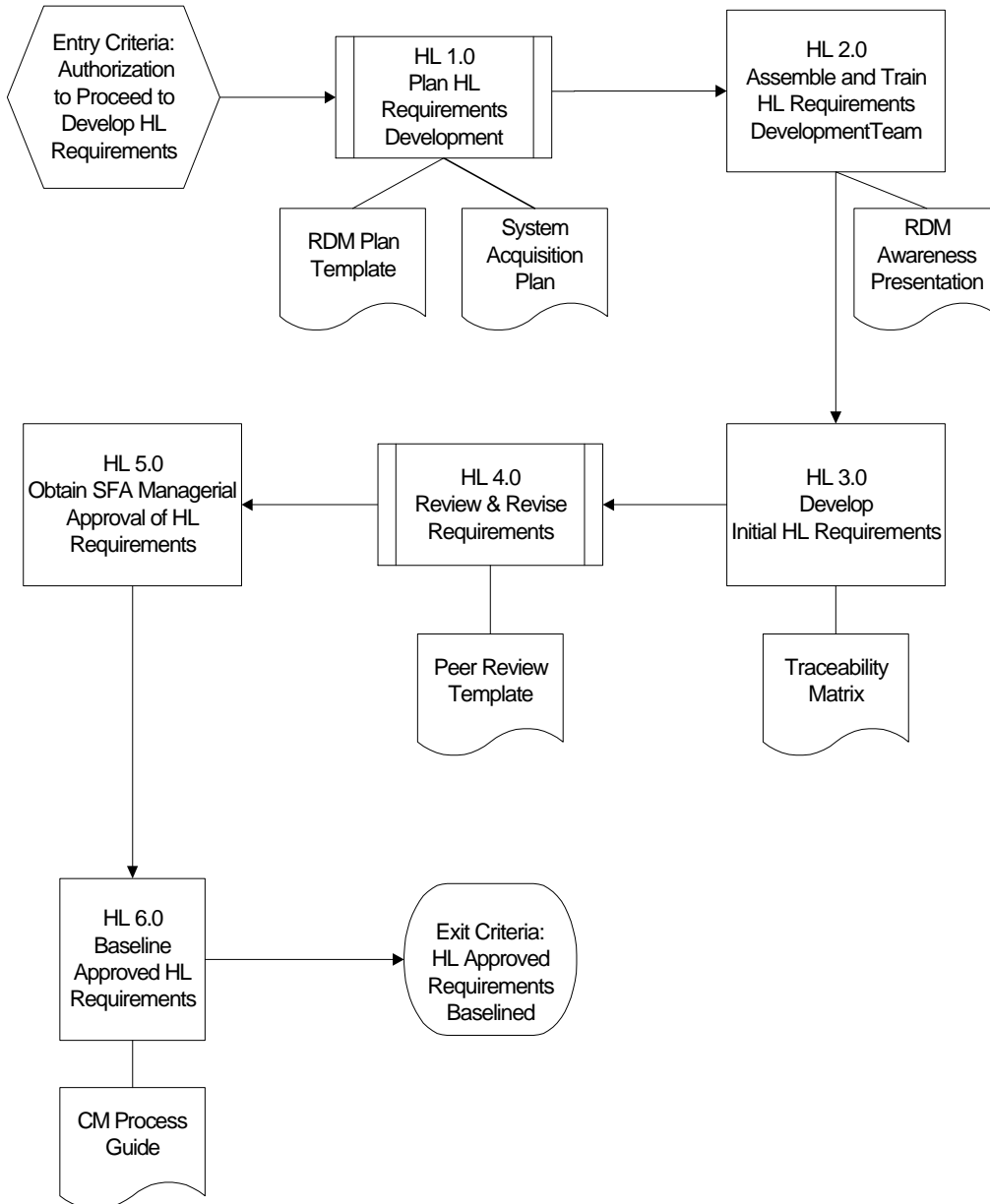### 2.2 High Level (HL) Requirements Development Process

Purpose

The High Level Requirements development process is used during the Vision phase of the Solutions Life Cycle. Its purpose is to chart at a high level what the system acquisition is to perform in terms of the business needs of SFA. These high level requirements are generally used in the business case, the Statement of Objectives (SOO) and the Task Order (TO). The High Level Requirements serve as the basis from which to derive low level contractual requirements.

Benefits

- Provide a systematic method to follow to ensure that the high level requirements developed accurately reflect the business needs of SFA.
- Include stakeholders such as User groups affected, beginning at an early stage to ensure that the HL requirements are appropriate to their needs.
- Increase "buy-in" of user groups by their inclusion in the HL requirements development process.
- Ensure a wise use of resources so that the system acquisition project has a greater chance of success at a cost-effective price.

High Level (HL) Requirements Development Process Flow

```
┌─────────────┐        ┌──────────────┐        ┌──────────────────┐
│ Entry Criteria: │     │  HL 1.0      │        │  HL 2.0          │
│ Authorization   │ ──▶ │  Plan HL     │ ──────▶│  Assemble and Train │
│ to Proceed to   │     │  Requirements │       │  HL Requirements │
│ Develop HL      │     │  Development  │       │  DevelopmentTeam │
│ Requirements    │     └──────────────┘        └──────────────────┘
└─────────────┘
```

RDM Plan Template   System Acquisition Plan

RDM Awareness Presentation

```
┌──────────────────┐   ┌──────────────┐        ┌──────────────────┐
│  HL 5.0          │   │  HL 4.0      │        │  HL 3.0          │
│  Obtain SFA      │ ◀─│  Review &    │ ◀──────│  Develop         │
│  Managerial      │   │  Revise      │        │  Initial HL      │
│  Approval of HL  │   │  Requirements │       │  Requirements    │
│  Requirements    │   └──────────────┘        └──────────────────┘
└──────────────────┘
```

Peer Review Template   Traceability Matrix

```
┌──────────────┐        ┌──────────────────┐
│  HL 6.0      │        │  Exit Criteria:  │
│  Baseline    │ ──────▶│  HL Approved     │
│  Approved HL │        │  Requirements    │
│  Requirements │       │  Baselined       │
└──────────────┘        └──────────────────┘
```

CM Process Guide

*High Level (HL) Requirements Development Process Steps*

IMPORTANT NOTE: *The Requirements Development and Management (RDM) Lead has the responsibility for the accomplishment of each process step, unless otherwise stated. Accordingly, the process steps are addressed to the RDM Lead.*

The Process of High Level Requirements Development generally begins and ends within the SLC Vision phase. In the course of a project development, however, new HL requirements may occasionally occur that need translation into LL requirements during the Definition, Construction, Deployment or Support phases of SLC. These HL requirements are generally used to develop the Business Case. Once the Business Case is approved, the Statement of Objectives (SOO) is generated, which documents the business objectives of SFA. SFA then awards the Task Order (TO) to the winning contractor.

Entry Criteria: -Authorization to Proceed to Develop HL Requirements - The authorization to proceed to develop HL Requirements ordinarily results from identification by the Executive Sponsor and/or Project Manager of needs that are to be satisfied by the acquisition of new Information Technology system(s). The RDM Lead is designated to develop the HL requirements.

HL 1.0 Plan HL Requirements Development –Estimate the RDM HL requirements development planning effort using the RDM Plan Template (refer to the Appendix). Assemble and train the HL requirements development team. Determine whether the project requires interfaces across SFA.
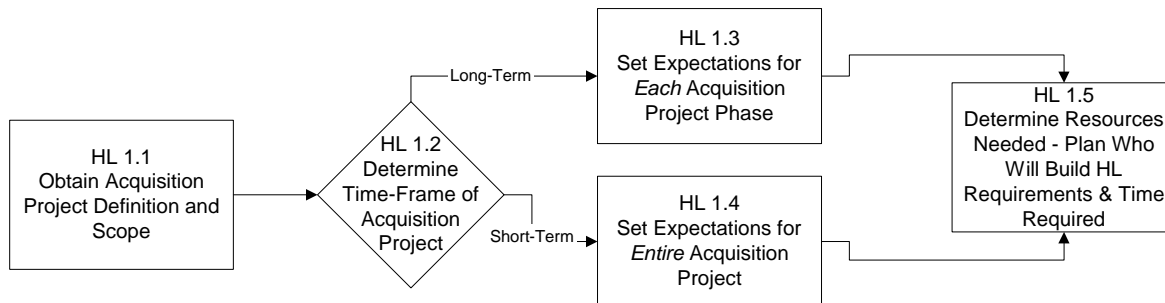
HL 1.1 Obtain Acquisition Project Definition and Scope– SFA management provides the business objectives and defines the scope of the proposed acquisition project; the scope typically resides in the scope section of the business case draft.

HL 1.2 Determine Time-Frame of Acquisition Project – Determine whether the acquisition project is a short-term or long-term project. The estimated length and complexity of the acquisition project will be reflected in the level of effort needed for the development of HL requirements.

HL 1.3 Set Expectations for Each *Acquisition Project Phase* – A long-term acquisition project such as a multi-year or multi-release project, is often broken into distinct phases. This allows expectations to be set and then communicated to the affected groups and to management for each project phase rather than for the entire project. Setting reasonable expectations is particularly important for each requirements project phase in areas such as resources required, dependencies, performance of the system, and expected date of completion. This information should be documented in the System Acquisition Plan using the Business Case Estimating Tool.

HL 1.4 Set Expectations for Entire *Acquisition Project* – For a short-term acquisition project, set appropriate expectations for the entire project among the affected groups and among management involved with the project. Setting reasonable expectations is particularly important for each requirements project phase in areas such as resources required, dependencies, performance of the system, and expected date of completion. *(Refer to System Acquisition Plan)*

HL 1.5 Determine Resources Needed - Plan Who Will Build HL Requirements & Time Required. Assess and assign what resources, including staff, equipment and tools, are needed for the development team as well as reasonable estimate of how long it will take to complete HL Requirements Development. *(Refer to RDM Plan Template in the Appendix)*

HL 2.0 Assemble and Train HL Requirements Development Team – Make allowance for the time needed to recruit and train team members, and for teambuilding, i.e. to make the team a functioning unit. *(Refer to RDM Awareness Training Presentation, RDM Plan Template in the Appendix).*
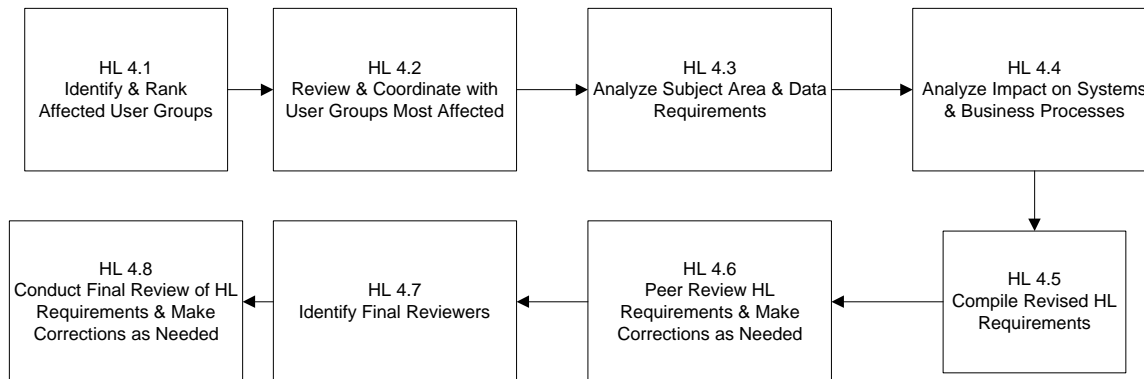
HL 3.0 Develop Initial HL Requirements – Working from initial guidance, determine what the acquisition system is supposed to do. Document each HL requirement, list them on the HL side of the traceability matrix and place the requirements under version control. As the requirements are modified and refined, keep a record of the previous versions. *(Refer to Traceability Matrix in the Appendix).*

 Here are some examples of High Level requirements taken from a particular SFA project.

- Ability to accommodate 4000 Institutions each containing up to three users.
- Capacity to provide online and store 5 years of institutional data and an additional 10 years of archived institutional data with the appropriate allocation of database space.
- Ability for Staff users to do reporting and ad/hoc querying from a particular database.
- Provide a web interface for institutions and the Department of Education.

HL 4.0 Review and Revise HL Requirements – Schedule and conduct user group, peer and final reviews of HL requirements. The HL requirements are refined and modified in several iterations as feedback from these groups becomes available. In addition, changes in the acquisition plan made by the System Acquisition Planning (SAP) group can affect how the system is to perform and thus affect the HL Requirements. *(Refer to System Acquisition Plan, Peer Review in the Appendix).*

```
┌──────────────────┐   ┌──────────────────┐   ┌──────────────────┐   ┌──────────────────┐
│     HL 4.1       │   │     HL 4.2       │   │     HL 4.3       │   │     HL 4.4       │
│  Identify & Rank │──▶│Review & Coordinate│──▶│Analyze Subject Area│─▶│Analyze Impact on │
│Affected User Groups│ │with User Groups  │   │& Data Requirements│   │Systems & Business│
│                  │   │ Most Affected    │   │                  │   │   Processes      │
└──────────────────┘   └──────────────────┘   └──────────────────┘   └──────────────────┘
                                                                               │
                                                                               ▼
┌──────────────────┐   ┌──────────────────┐   ┌──────────────────┐   ┌──────────────────┐
│     HL 4.8       │   │                  │   │     HL 4.6       │   │     HL 4.5       │
│Conduct Final Review│ │     HL 4.7       │   │ Peer Review HL   │   │ Compile Revised  │
│of HL Requirements &│◀│Identify Final    │◀──│Requirements & Make│◀─│ HL Requirements  │
│ Make Corrections   │ │  Reviewers       │   │Corrections as Needed│ │                  │
│   as Needed        │   │                  │   │                  │   │                  │
└──────────────────┘   └──────────────────┘   └──────────────────┘   └──────────────────┘
```

HL 4.1 Identify & Rank Affected User Groups - Identify which user groups will be affected by the acquisition project and rank them from most affected to least affected in order to concentrate the gathering of user comments on the groups most affected.

HL 4.2 Review & Coordinate with User Groups Most Affected – Meet with members and/or representatives of the user groups most affected by the acquisition project to obtain their comments and concerns regarding each initial business requirement. These same groups will be consulted for their input during the Low Level Requirements Development Process.

HL 4.3 Analyze Subject Area & Data Requirements – Determine and specify the data, data sources and systems to be used in the acquisition project.

HL 4.4 Analyze Impact on Systems & Business Processes – Determine which other SFA Channels and/or projects will be affected by the acquisition project and how they will be affected.

HL 4.5 Compile Revised HL Requirements – The HL requirements are revised based on the information gathered from the user groups and on the analysis of system impacts. Update the HL requirements in the HL side of the traceability matrix. *(Refer to Traceability Matrix in the Appendix).*

HL 4.6 Peer Review HL Requirements & Make Corrections as Needed – Have colleagues with expertise in RDM perform an internal review of HL Requirements and make necessary modifications and revisions. *(Refer to System Acquisition Plan, Peer Review in Appendix)*

HL 4.7 Identify Final Reviewers – Determine what persons and/or what groups will perform the final review of the HL Requirements before they are submitted to SFA Management for approval.

HL 4.8 Conduct Final Review of HL Requirements & Make Corrections, as Needed – After Peer Review, the group of final reviewers meets to review the HL Requirements before they are submitted for management approval. Update the HL requirements in the HL side of the traceability matrix.

HL 5.0 Obtain SFA Managerial Approval of HL Requirements – SFA managerial approval needs to be obtained at the appropriate levels. If final SFA managerial approval is obtained, then proceed to next process. If SFA management level approval is not obtained, then return to *Plan HL Requirements Development (HL 1.0)* for further refinement of acquisition project definition and scope.

HL 6.0 Baseline Approved HL Requirements – Baseline the approved HL requirements, so that any future changes can be documented, tracked and managed. These HL requirements are generally used in the Business Case. Once the Business Case is approved, the Statement of Objectives (SOO) is generated, which documents the business objectives of SFA. SFA then awards the Task Order (TO). HL requirements will also be used in the development of the Low Level Requirements. *(Refer to CM Process Guide)*

Exit Criteria: Approved HL Requirements are Baselined – the approved and baselined HL Requirements form the basis for the development of Low Level requirements. The HL requirements will be extracted in the beginning steps of the LL requirements development process.

2.3   Low Level (LL) Requirements Development Process

Purpose

The Low Level Requirements Development Process is designed to provide a systematic method to follow to produce high quality unambiguous low level or functional requirements. These requirements will be traceable to specific high level requirements and will be testable.

Benefits

- Provide a systematic method to follow to ensure that the low level requirements developed accurately trace to the high level requirements of SFA.

- Include stakeholders such as User groups affected beginning at an early stage to ensure that the LL requirements are appropriate to their needs.

- Ensure that the system to be acquired is compatible with existing or planned SFA systems.

- Increase "buy-in" of user groups by their inclusion in the LL requirements development process.

- Ensure a wise use of resources in RDM so that the system acquisition project has a greater chance of success at a cost-effective price.

- Eliminate as much as possible the need for re-work of requirements.

Low Level Requirements Development Process
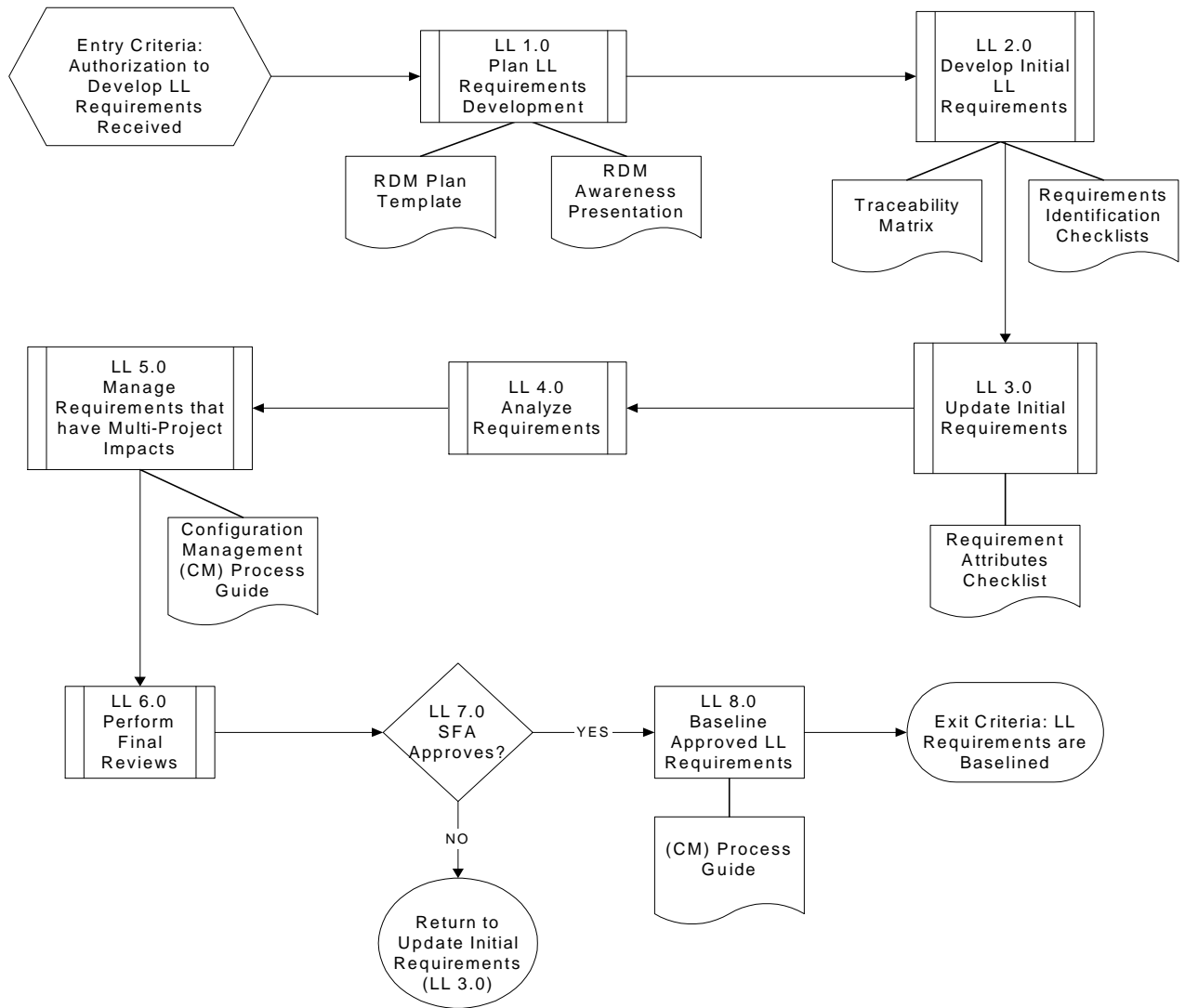
Low Level Requirements Development Process Steps

IMPORTANT NOTE: The Requirements Development and Management (RDM) Lead has the responsibility for the accomplishment of each process step, unless otherwise stated. Accordingly, the process steps are addressed to the RDM Lead.

Entry Criteria – Authorization to Develop LL Requirements Received – If the approval process takes the Decision Support Group (DSG)/Investment Review Board (IRB) path, the authorization to proceed to develop LL requirements will arrive after the business case is approved and the Task Order (TO) is signed or an Authorization to Proceed (ATP) is in place. Other paths that lead to the authorization to proceed exist, such as the use of system maintenance or the continuation of multi-year contracts.

LL 1.0   Plan LL Requirements Development - Estimate the low level requirements development planning effort using the RDM Plan Template. Assemble and train the LL requirements development team. Extract the approved baselined High Level (HL) requirements. Determine whether the project requires interfaces across SFA. (*Refer to RDM Plan Template in the Appendix, RDM Awareness Presentation)*
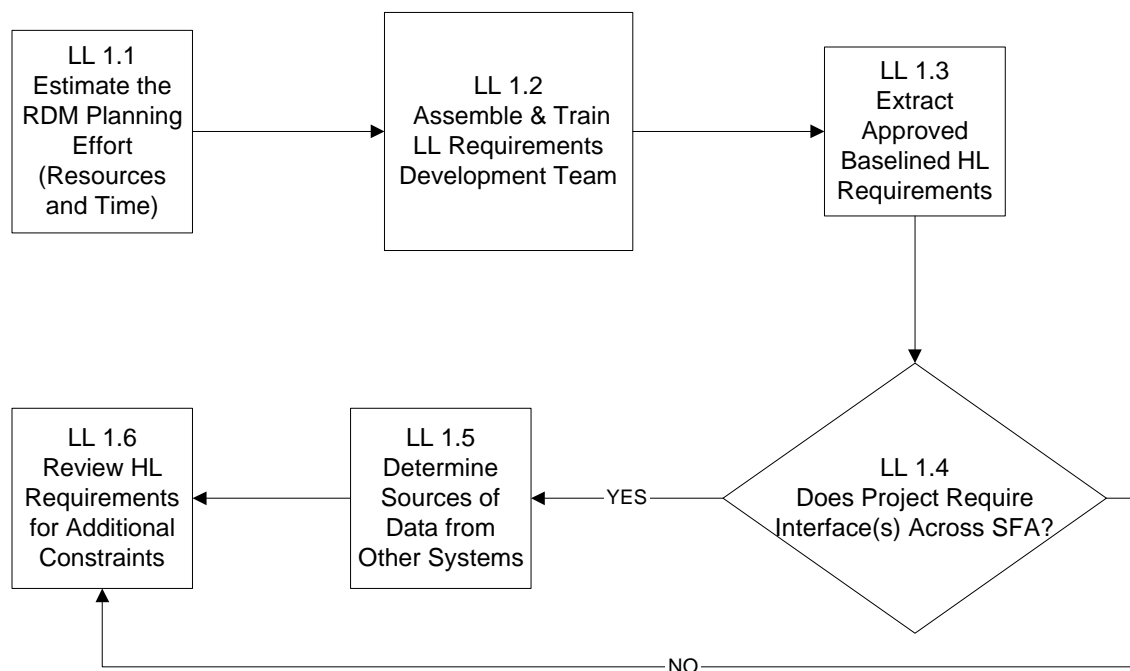
LL 1.1   Estimate the RDM Planning Effort (Resources and Time) - RDM Lead assesses what resources, including staff, equipment and tools are required for the development team. Also, make a reasonable estimate of how long it will take to complete the LL Requirements Development. Make allowance for the time needed to recruit, to assemble, to train the team members and to make the team a functioning unit. Assign resources to the RDM effort. *(Refer to RDM Plan Template in the Appendix)*

LL 1.2   Assemble and Train LL Requirements Development Team - Assemble and train, if needed, the team members. *(Refer to RDM Plan Template in the Appendix, RDM Awareness Presentation)*

LL 1.3   *Extract Approved Baselined HL Requirements -* The approved HL requirements were baselined at the end of the High Level Requirements Development Process. Use the Change Control Group (CCG) that has been developed in the Configuration Management process, or if it has not been established see the Project Manager regarding establishment of the Project CCG. *(Refer to CM Process Guide)*

LL 1.4   *Does Project Require Interface(s) Across SFA? -* Determine whether the impact of the system project remains limited to its own system or whether the impact of the project crosses into other systems across SFA. If YES, proceed to *Determine Sources of Data from Other Systems*. If NO, proceed to *Review HL Requirements for Additional Constraints.*

LL 1.5   Determine Sources of Data from Other Systems – Determine what other systems already have data and data definitions that are needed for the project.

LL 1.6   Review High Level (HL) Requirements for Additional Constraints – Examples of high level constraints include non-technical management expectations such as products to be delivered, delivery dates, milestones, or resources. *(Refer to RDM Plan Template in the Appendix)*

LL 2.0 Develop Initial LL Requirements– Use the HL traceability matrix (see HL 3.0) to detail the HL requirements into LL requirements, draft LL requirements, and enter them in the traceability matrix. *(Refer to Traceability Matrix and Requirements Identification Checklist in the Appendix)*

```
┌──────────────┐     ┌──────────────┐     ┌──────────────┐
│   LL 2.1     │     │   LL 2.2     │     │   LL 2.3     │
│  Recall HL   │────▶│  Detail HL   │────▶│ Draft Initial LL │
│ Traceability │     │ Requirements │     │ Requirements │
│   Matrix     │     │   into LL    │     │              │
│              │     │ Requirements │     │              │
└──────────────┘     └──────────────┘     └──────────────┘
```
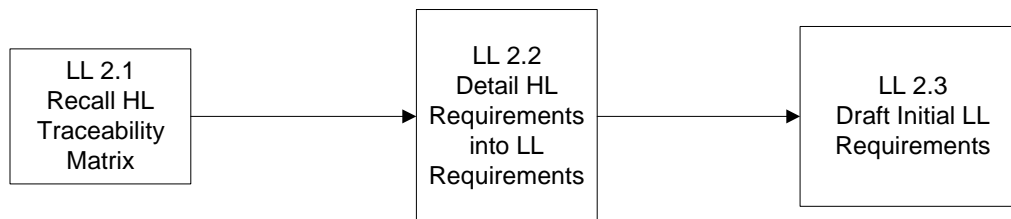
LL 2.1 Recall HL Traceability Matrix   – Use the HL traceability matrix (see HL 3.0) for the RDM of the project. Ensure each HL requirement is entered in the matrix. *(Refer to Traceability Matrix in the Appendix)*

LL 2.2 Detail HL Requirements into Initial LL Requirements – Decompose the HL requirements into LL requirements. Refer to the Requirements Identification Checklists in the RDM Process Guide. Include functional, non-functional, and non-technical requirements. *(Refer to Requirements Identification Checklist in the Appendix)*

LL 2.3 Draft Initial LL Requirements – Carefully word each LL requirement into a concise, uniquely identifiable statement, and enter the requirement in the traceability matrix, matched to a particular HL requirement. Each LL requirement supports or helps to support an HL requirement. If a LL requirement does not support an HL requirement, it may be out of scope. Conversely, ensure that each HL Requirement is supported by one or more testable requirements. If an HL requirement is not supported by any LL requirement, a new LL requirement may be needed to support the HL requirement. Also assign each LL requirement a unique identification number. Institute version control when the first LL requirements are placed in the traceability matrix.

LL 3.0 Update Initial Requirements – Gather and document end user groups' comments. Document and assimilate appropriate comments into the LL requirements, updating them in the traceability matrix. Meet with the testing and architecture teams to understand the testability and architectural standards that impact LL requirements. Check the LL requirements for completeness, testability, and applicability. Arrange test group review to ensure testability of requirements.
(Refer to Requirement Attributes Checklist in RDM Plan Template, Traceability Matrix in the Appendix)

```
┌──────────────┐        ┌──────────────┐        ┌──────────────┐
│ LL 3.1       │        │              │        │ LL 3.3       │
│ Gather &     │        │ LL 3.2       │        │ Meet with    │
│ Document     │        │ Document &   │        │ Testing &    │
│ Comments/    │───────▶│ Assimilate   │───────▶│ Architecture │
│ Needs from   │        │ User         │        │ Teams to     │
│ End Users &  │        │ Comments     │        │ Understand   │
│ Other        │        │              │        │ Standards &  │
│ Affected     │        │              │        │ Testability  │
│ Groups       │        │              │        │              │
└──────────────┘        └──────────────┘        └──────────────┘
                                                        │
                        ┌──────────────┐                ▼
┌──────────────┐        │ LL 3.5       │        ┌──────────────┐
│ LL 3.6       │        │ Test Group   │        │ LL 3.4       │
│ Update LL    │        │ Reviews      │        │ Ensure All LL│
│ Requirements │◀───────│ Requirements │◀───────│ Requirements │
│ in Tracea-   │        │ to Ensure    │        │ are Complete │
│ bility       │        │ Testability  │        │              │
│ Matrix       │        │              │        │              │
└──────────────┘        └──────────────┘        └──────────────┘
```
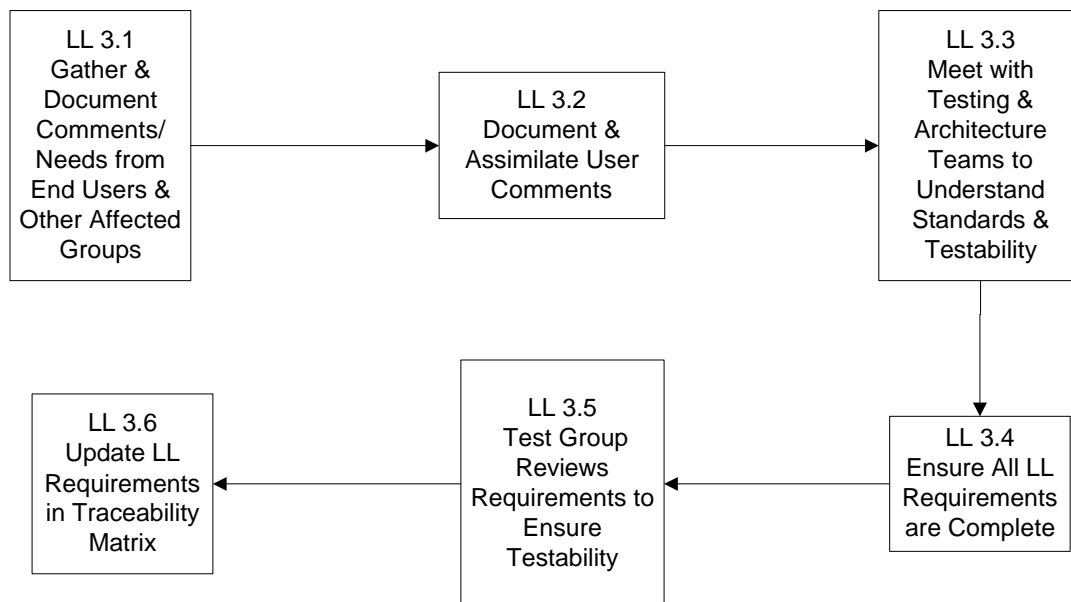
LL 3.1 Gather Comments/Needs from End Users & Other Affected Groups – Use an existing documentation review process, work pattern observation, interview sessions, questionnaires, or other techniques. Refer to the list and ranking of affected user groups produced in the HL development process. Limit the duration of this phase of the RDM process to a reasonable length of time. Remember that the LL requirements will undergo several more reviews before approval.

LL 3.2 Document & Assimilate User Comments – Analyze user comments to identify any hidden or missing functional user needs. Determine if the user comments are within scope of the HL requirements and whether or not they provide new insight into needed system capabilities. Document for verification all decisions reached as to whether or not the comments are suitable to be assimilated into the LL requirements.

LL 3.3 Meet with Testing & Architecture Teams to Understand Standards & Testability – Before revising the LL requirements further, arrange meetings with the Testing and Architecture teams to understand how the architectural standards and the testability standards impact the LL requirements.   In addition, changes in the acquisition plan made by the System Acquisition Planning group can affect how the system is to perform and thus affect the HL Requirements.

LL 3.4 Ensure All LL Requirements are Complete– the LL requirements must be non-ambiguous, verifiable, feasible, accurate, traceable, readable, understandable and without adjectives or jargon. Review the wording of each requirement, and refine or revise as necessary. Ensure that all HL requirements are addressed in LL requirements. Using the traceability matrix, check that every input to the system is specified and has a corresponding appropriate output. Review the LL requirements to make sure that they meet all architectural, testability and other applicable standards. *(Refer to Requirement Quality Checklist in the Appendix)*

LL 3.5 *Test Group Reviews Requirements to Ensure Testability* – The group that will be testing the system reviews the requirements to make sure that they are testable.

LL 3.6 Update LL Requirements in Traceability Matrix – Modify the LL requirements to take into account both the appropriate user comments and the impact of the testing and architectural standards on the LL requirements. Incorporate in the Traceability Matrix the changes to the LL requirements made in *LL 3.4 Ensure All LL Requirements are Complete. (Refer to Traceability Matrix in the Appendix)*

LL 4.0   Analyze Requirements - Analyze the updated LL requirements to ensure they are consistent with the expected scope of the project. Ensure that inconsistent requirement issues are resolved. Review LL requirements for multi-project impacts. *(Refer to Impact Analysis Matrix in the Appendix)*

```
                                                    ┌──────────────┐
┌──────────────┐         ╱◇╲                        │   LL 4.3     │
│   LL 4.1     │        ╱    ╲                       │   Discuss    │
│  Review LL   │       ╱ LL 4.2 ╲        NO          │ Inconsistent │
│ Requirements │──────▶ LL Requirements ─────────────▶│     LL       │
│     for      │       ╲ Consistent with╱            │ Requirements │
│  Consistency │        ╲  Scope?  ╱                  └──────────────┘
│  with Scope  │         ╲◇╱                                 │
└──────────────┘          │                                  ▼
                         YES                           ╱◇╲
                          │                           ╱    ╲
                          ▼                          ╱ LL 4.4 ╲
┌──────────────┐    ┌──────────────┐    YES         ╱ Can Scope ╲
│   Exit:      │    │   LL 4.5     │◀──────────────◀ Accomodate  ╲
│ Discuss TO/  │    │  Review LL   │                ╲ Inconsistent╱
│  Contract    │    │ Requirements │                 ╲    LL     ╱
│ Modification │    │ for Multi-   │                  ╲Requirements?╱
└──────────────┘    │Project Impacts│                  ╲◇╱
         ▲          └──────────────┘                    │
         │                                              │
         └──────────────────── NO ──────────────────────┘
```
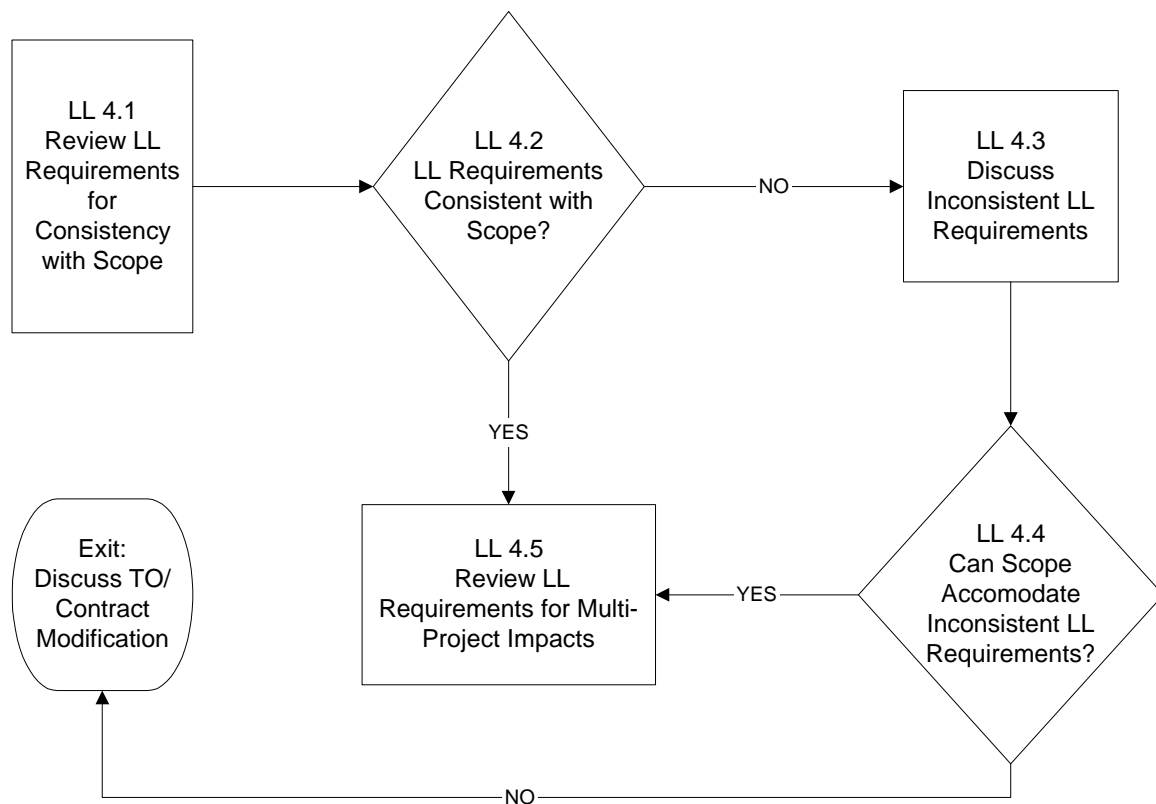
LL 4.1   Review LL Requirements for Consistency with Scope– The RDM Lead determines which of the LL requirements (if any) conflict with the scope of the project.

LL 4.2   LL Requirements Consistent with Scope? – If NO, (the RDM Lead determines that the LL requirements are not consistent with the Scope (see High Level Development Process Flow Chart) proceed to *Discuss Inconsistent LL Requirements (LL 4.3).* If YES, proceed to *Review LL Requirements for Multi-Project Impact (LL 4.5)*

LL 4.3   Discuss Inconsistent LL Requirements – **(TO IPT LEAD)** if any LL requirements are inconsistent with the project scope (i.e. "scope creep"), they will need to be discussed with the COTR (Contracting Officer Technical Representative) and the CO (Contracting Officer) to see if these LL requirements can be accommodated within the scope.

LL 4.4   Can Scope Accommodate Inconsistent LL Requirements? If YES, proceed to *Review LL Requirements for Multi-Project Issues.* If NO, proceed to *Discuss TO/Contract Modification.*

LL 4.5   Review LL Requirements for Multi-Project Issues -The RDM Lead and the IPT Lead determine whether or not the LL requirements have an impact on other existing SFA systems or current or planned projects. Impacts include conflicts in standards, hardware, user interfaces, Commercial Off The Shelf Software (COTS), system architecture and other issues that may arise.

Exit: Discuss TO/Contract Modification - This step is out of the scope of the RDM team. Consult with the IPT Lead for guidance.

LL 5.0   Manage Requirements that have Multi-Project Impacts - When multi-project impacts are present (see HL 4.5) review these with the Integrated Product Team (IPT) Lead. If necessary, arrange to bring these multi-project impacts to Enterprise Configuration Management (ECM) for review and resolution. Obtain peer review of LL requirements. (*Refer to CM Process Guide*)
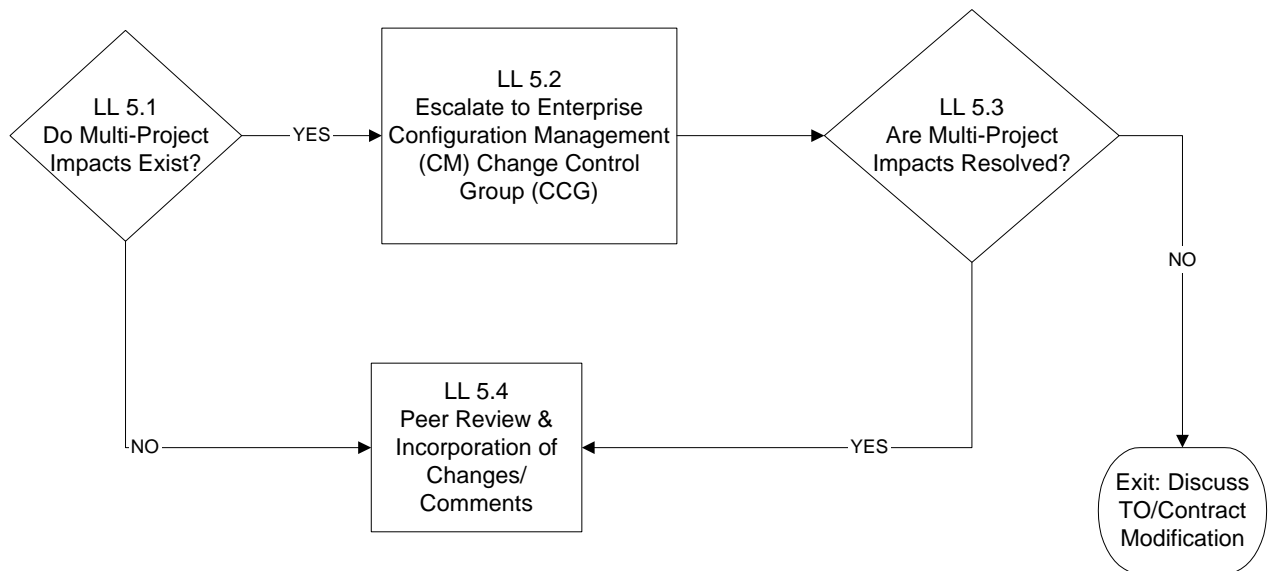
LL 5.1   *Do Multi-Project Issues Exist?* - If YES, proceed to *LL 5.2 Escalate to Enterprise Configuration Management (CM) Change Control Group (CCG)*. If NO, proceed to *LL 5.4 Peer Review & Incorporation of Changes/Comments.*

LL 5.2   *Escalate Multi-Project Issues to Enterprise CCG for Review* – If the Project CCG finds multi-project issues generated by the LL requirements, then the IPT Lead takes these issues to the Enterprise CCG for review. (*Refer to CM Process Guide*)

LL 5.3   *Are Multi-Project Impacts Resolved?* – If YES, the Enterprise CCG resolves multi-project impacts, then the LL requirements are sent for Peer Review. If NO, the Enterprise CCG does not resolve the multi-project impacts, the impact goes out of the scope of the RDM team; a modification of the TO/Contract will be necessary.

LL 5.4   *Peer Review & Incorporation of Changes/Comments -* Have associates with expertise in RDM perform an internal review of LL Requirements. Appropriate changes and comments are incorporated into the LL requirements.

Exit *Discuss TO/Contract Modification -* This step is out of the scope of the RDM team. Consult with the Project Manager for guidance.

LL 6.0 Perform Final Reviews - Arrange reviews of the LL requirements, such as Peer Review, Quality Assurance review, and User review. Incorporate the resulting changes in the LL requirements and update the traceability matrix before sending them to the appropriate SFA management level for approval.

```
┌──────────────────┐      ┌──────────────────┐      ┌──────────────────┐
│      LL 6.1       │      │      LL 6.2       │      │      LL 6.3       │
│  Conduct Quality  │─────▶│   Conduct User    │─────▶│  Send to SFA  for │
│ Assurance Review  │      │      Review       │      │     Approval      │
└──────────────────┘      └──────────────────┘      └──────────────────┘
```
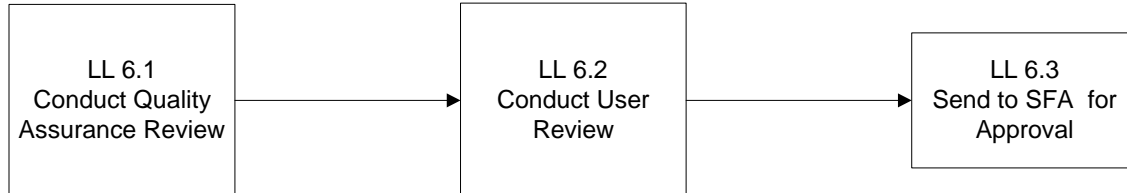
LL 6.1 Conduct Quality Assurance Review – A Quality Assurance (QA) review of the LL requirements is conducted by the Quality Assurance Team. Incorporate appropriate changes and comments into the LL requirements and revise the Traceability Matrix accordingly.

LL 6.2 Conduct User Review – representative(s) of the user and other affected groups review the LL requirements for approval. Obtain sign-offs from all affected User Representatives & project team representatives.

LL 6.3 Send to SFA for Approval - The LL requirements are sent to the appropriate SFA management level for approval. Note: Other avenues, not related to RDM, may be required. In some cases, this occurs at the beginning of a contract or in other cases at the end of a contract, or still in others at an overview of maintenance.

LL 7.0 SFA Approves? - If the appropriate management level of SFA approves, then the RDM Lead proceeds to baseline the LL requirements. If the SFA does not approve the requirements, then they are returned to the RDM team for revision.

LL 8.0 Baseline LL Requirements - Baseline approved requirements. Place baselined requirements under Configuration Management control. *(Refer to CM Process Guide)*

Return to Update Initial Requirements (LL 3.0) -The LL requirements need revision based on the reasons for disapproval of the LL requirements.

Exit Criteria: LL Requirements are Baselined - This step represents the end of the process of Requirements Development during the definition phase of the SLC and the beginning of Requirements Management.

3.0 REQUIREMENTS MANAGEMENT PROCESS

3.1 Purpose

The purpose of the Requirements Management Process is to:

- Ensure that, throughout the life of the system, the requirements are baselined and all changes to the Requirements are controlled.

- Ensure that affected plans, work products, and activities are modified to remain consistent with the updated Requirements.

SFA uses the CM process guide to manage changes. Change management begins as a process once the set of requirements have been baselined. All changes (whether they be defects, incidents, change requests, etc.) are initiated as Change Requests. If the change is deemed a Baselined Requirements change, the originator of the Change Request will assign the change to the RDM Lead. This assignment initiates the activities and tasks in this section.

Tracing requirements, both forward and backward, is essential to verifying that Baselined Requirements are met. The Trace Forward to Verify Baselined Requirements are Satisfied activity is a parallel, on-going activity in this process. First, each Baselined Requirement is traced forward to resulting work products as they are developed. Next, as Change Request are incorporated into the requirements baseline, the resulting set of Baselined Requirements are traced forward to existing and resulting work products as well as back to Preliminary Requirements, User Needs, and business objectives.

Measurement of the business objectives, as stated in the Statement of Objectives (SOO), is important to verify that the objectives have been met. *(Refer to RDM Measurement and Analysis in the Appendix)*

Benefits

The Requirements Management Process lowers cost, development time, and increases user satisfaction by:
- involving end users throughout the life cycle of the system
- reducing errors and rework by correcting flaws early
- reducing the introduction of errors due to loss of integrity while making changes

Entry Criteria

Requirements Development is complete. Baseline is established. Requirements Management begins.

Exit Criteria

Life of the system is over (i.e., the system is no longer operational and is not being maintained).

Inputs & Output
Inputs
- Baselined Requirements
- Open and Working Change Requests

Outputs
- Accepted or Returned Change Requests
- Completed Working Change Requests
- New version of Baselined Requirements

3.2   Relationships to Other Processes & Documents

The activities and work products of the Requirements Management process are related to other project processes or documents as defined below:

- Configuration Management Change Control procedures are in effect for managing all changes to Baselined Requirements

- Configuration Management Change Control Group Approval procedures are in effect for approval of all changes to all Baselined Requirements

- Configuration Management Baselining procedures will be used to establish the Requirements Baseline

3.3   Activities

The activities and tasks for the Requirements Management process is described in more detail in two diagrams which depict different aspects of this procedure.

- Figure 3.4 presents the basic flow of the activities for the Requirements Management process.
- Table 3.4 describes the activities for the Requirements Management process.

Figure 3.4 is intended to simplify understanding of the process. It is not meant to imply that a strict ordering or waterfall approach must be followed. Project teams should focus on completing all the activities, tasks, and reviews, and use their judgment in the actual accomplishment of the tasks.

In Table 3.4, each activity is defined by a set of tasks. The tasks are described by a list of steps (i.e., bulleted items) necessary to accomplish the task. Where they are available, techniques and tools are recommended. Recommended techniques for each task are listed in the techniques column. Recommended tools for each overall task are listed in the tools column. When the recommended tool is a checklist, form or matrix designed specifically to support these activities, a sample is presented. Recommendations for what role(s) is responsible for accomplishing the task are provided in the right-most column.

Figure 3.4: Requirements Management

```
                              ┌─────────┐
                              │  Begin  │
                              └────┬────┘
                                   │          ┌──────────────────────┐
                                   │          │        TRACE         │
                                   │          │ Trace Forward to Verify │
                                   │          │ Baselined Requirements │
                                   │          │    are Satisfied     │
                                   │          └──────────────────────┘
                              ┌────▼─────────┐
                              │  MANAGE1     │
                              │  Evaluate    │
                              │  Open Change │
                              │  Request     │
                              └────┬─────────┘
                                   │
                              ╱────▼────╲
                             ╱ Does the  ╲
                            ╱ change need: ╲   Yes
                           ╱ more clarification?╲───────►
                           ╲ more analysis?     ╱
                            ╲better assessment ╱
                             ╲ of impact?     ╱
                              ╲──────┬───╲
                                 No  │
                              ┌──────▼────────────┐
                              │     MANAGE2       │
                              │ Submit evaluated Open│
                              │ Change Request to  │
                              │       SCCB as      │
                              │ "Returned" or "Accepted" │
                              └──────┬────────────┘
                              ┌──────▼────────────┐
                              │     MANAGE3       │
                              │ Implement Working  │
                              │  Change Request    │
                              │     to Set of      │
                              │ Baselined Requirements │
                              └──────┬────────────┘
                              ┌──────▼────────────┐
                              │     MANAGE4       │
                              │ Complete Working   │
                              │  Change Request    │
                              └──────┬────────────┘
                              ┌──────▼──────┐
                              │ Go To Next  │
                              │ Procedure   │
                              └─────────────┘
```

Table 3.4: Activities & Tasks for Requirements Management			
	Techniques	*Tools* 💾	*Responsibility*
ACTIVITY: Evaluate Open Change Request			
TASK: Receive Open Change Request		Change Request	Software Requirements Manager
TASK STEP:			System Analyst
• The initial state of a Change Request is "Open" as specified in Configuration Management (see SLC). Review the Open Change Request at a high-level and decide if more information is needed to process the Open Change Request.			
• If the Open Change Request is unclear on how the Baselined Requirements are involved, return the Open Change Request to the originator.			
• If the Open Change Request seems to affect the Baselined Requirements in some way, assign the Open Change Request to a System Analyst.			
TASK: Clarify Open Change Request		Change Request	System Analyst
TASK STEPS:			
• Review all information on the Open Change Request. Ask the following questions to see if adequate information has been provided:			
• Does the Open Change Request seem to affect any Baselined Requirements?			
• Is this Open Change Request a feature to be added which needs Requirements established and included in the existing Baseline?			
• Is this Open Change Request a defect to be corrected which creates a discrepancy between Baselined Requirements and another Configuration Item (CI)?			

Table 3.4: Activities & Tasks for Requirements Management			
	Techniques	*Tools* 🖫	*Responsibility*
• Are the expectations of the Open Change Request originator clear? • If the Open Change Request does not seem applicable to Baselined Requirements or if additional information is needed, return it to the originator.			
TASK: Identify & Document All Impacted Baselined Requirements **TASK STEPS:** • Identify changes needed to any Baselined Requirements. • Review the set of Baselined Requirements for specific Requirements that will be impacted when incorporating the Open Change Request. • Identify obvious Baselined Requirements that are affected. • Identify dependent requirements affected by reviewing information on known impacted Baselined Requirements. • Identify additional Baselined Requirements impacted by reviewing any applicable traceability matrices to find associations with the known impacted Baseline Requirements. • Document each impacted Baselined Requirement and the findings for each into the Description section of the Change Request. • Review requirements-work products traceability matrices to identify any affected work products(e.g. designs, test scripts, and documentation) • If the Open Change Request affects any Baselined Requirements, accept the Open Change Request for consideration. • If the Open Change Request does not seem to apply to any Baselined Requirements, reassign the Open Change Request to a more	*See Impact Analysis in Appendix*	Traceability Matrices Change Request	System Analyst

Table 3.4: Activities & Tasks for Requirements Management			
	Techniques	*Tools* 💾	*Responsibility*
appropriate SCI (i.e., Design, Code, Test Plans, Documentation) under Configuration Management or return it to the originator following the CM Change Control procedures.			
TASK: Analyze & Design Possible Solution(s)		MS Word	System Analyst
TASK STEPS:		MS PowerPoint	
• Review the updated Open Change Request to gain understanding of the overall impact.			
• Design alternative ways to incorporate the requested change.			
• For each alternative, show how the impacted Baselined Requirements would need to be modified and/or if any additional requirements must be added to the baseline in order to incorporate the requested change.			
• Document all alternative design solutions.			
TASK: Determine Work Effort & Resources Affected	Estimating procedures		Project Manager
TASK STEPS:			
• For each alternative solution, estimate the work effort and any scheduled impacts to resources due to the incorporation of the Open Change Request into the system.			
TASK: Review Design Solution(s) & Estimates		Change Request	Project Manager
TASK STEPS:			
• Review design solutions and associated estimates for feasibility.			

Table 3.4: Activities & Tasks for Requirements Management			
	Techniques	*Tools* 💾	*Responsibility*
• Select a design solution, and document it on the Change Request form.			

ACTIVITY: Return Evaluated Open Change Request to Change Control Group (CCG) as "Returned" or "Accepted".
 	
TASK STEPS:
 	
  • If it is decided that implementing the Open Change Request is feasible, the evaluated Change Request is marked as "Accepted" and returned to the CCG.
 	
  • If it is decided that implementing the Open Change Request is not feasible, the evaluated Change Request is marked "Returned" and returned to the CCG.
		Change Request	Requirements Manager
			
			Project Manager

ACTIVITY: Implement Working Change Request to Set of Baseline Requirements
 	
TASK: Develop High Level Requirement(s) from Working Change Request
 	
TASK STEPS:
 	
  • Once the CCG approves the Change Request, the Change Request's status changes to "Working" and is assigned to the System Analyst who will:
 	
  • Create a High Level Requirement from the Working Change Request
 	
  • See the High Level Procedure
 	
TASK: Develop Low Level Requirement(s) from the High Level Requirements Developed in the Previous Step
			Requirements Manager
			
			System Analyst
			
			System Analyst

Table 3.4: Activities & Tasks for Requirements Management			
	Techniques	*Tools* 💾	*Responsibility*
TASK STEPS: • See the Low Level Procedure			
TASK: Baseline Requirement(s) Analyzed in the Previous Step **TASK STEPS:** • Receive approval for new/revised low level requirements • Enter the new/revised requirements into the repository		Rational	System Analyst
ACTIVITY: Complete Working Change Request **TASK STEPS:** Once the changes defined in the Working Change Request have been incorporated, sign and date the Working Change Request and forward it to the CM Group.		Change Request	Requirements Manager
ACTIVITY: Trace Forward to Verify Baselined Requirements are Satisfied **TASK:** Create Forward Traceability Matrix **TASK STEPS:** • Identify what each Requirement should be traced forward to. Consider the following work products: • Design documentation • System specifications • Test plans • Test scripts		MS Excel Rational	

Table 3.4: Activities & Tasks for Requirements Management			
	Techniques	*Tools* 💾	*Responsibility*
• System development plans			
• Source code			
• Training Documentation			
• Installation Documentation			
• System Documentation			
• User Documentation			

TASK: Trace Requirements Forward
 	
• To ensure that each Baselined Requirement is satisfied by one or more work products, trace each Baselined Requirement to the identified work products that support it. This is an on-going task for the life of the system.
 	
• Review the matrix and ensure that there is one or more work products that exist to help satisfy one of more Baselined Requirements.
 	
• If a Baselined Requirement exists without the "Where Satisfied" field satisfactorily fulfilled, investigate to determine which of the situations below applies and follow up by performing the specified action:
 	
    • The Status is "to-be-determined." Make sure that the status is still valid at this point and that it is not possible to assign a status of in-scope or out-of-scope yet.
 	
    • Baselined Requirement is valid. Work with the project team to ensure that work products are correctly and promptly modified or added to satisfy the valid Baselined Requirement.
		Requirements-Work Product Traceability Matrix
		
		Change Request Form
		
		Rational
			Requirements Manager

Table 3.4: Activities & Tasks for Requirements Management			
	Techniques	*Tools* 🖫	*Responsibility*
• Baselined Requirement is not valid. Modify the Baselined Requirement (via a Change Request and CM procedures) so that it is valid. Repeat the trace or delete the Baselined Requirement. • Use the matrix to ensure that each work product helps to satisfy one or more Baselined Requirements. If a work product exists that does not have at least one Baselined Requirement, investigate to determine if a Baselined Requirement should be added to account for the work product or if the work product is not needed.			

3.4   Measurement and Analysis

Refer to Appendix C, RDM Measurement and Analysis

4.0 APPENDIX A – REQUIREMENTS IDENTIFICATION CHECKLIST

Note: Use the following checklist to aid in the development of Low Level requirements. All items are not applicable to all system solutions. Choose the items that are applicable to the project system solution.

Low Level Requirements Identification Checklist

- System Capability
    - ⇒ Is every expected system behavior defined as a requirement?
    - ⇒ Review each type of affected group (e.g., end user, system operator, system administrator) to determine if their needs are defined as a requirement.
    - ⇒ Review each event to determine if there are requirements defined to respond to each event?
    - ⇒ Are all on-line processing requirements described?
    - ⇒ Are all batch processing requirements described?
    - ⇒ Have all data processing and editing needs been considered, including input data, output data, and reference data?

- Reporting
    - ⇒ Is there any need to summarize and report on data captured by the system?
    - ⇒ Are the reports to be batch or on-line?
    - ⇒ What information should be reported on and how should the information be presented (e.g., on screen, paper, to a file)?
    - ⇒ Is there any need to support ad-hoc user reporting?
    - ⇒ What is the estimated volume of the report in pages?
    - ⇒ What is the frequency of report generation?
    - ⇒ Do the reports vary by type of user?

- Error Handling
    - ⇒ What errors can be expected and how should they be handled?
    - ⇒ Are there specific error messages to be displayed for unexpected, but potentially common user behavior?

- Historical Data
    - ⇒ Is there a need to capture historical data?

Low Level Requirements Identification Checklist

Performance

- ◆ Capacity

   ⇒ What is the expected number of users the system must handle at any point in time?

   ⇒ What is the maximum number of expected system users?

   ⇒ What is the maximum number of concurrent system users?

   ⇒ What type and how may hardware components (e.g., DASD, printers, plotters, modems) must the system handle?

   ⇒ What should the system do when maximum capacities for users or hardware components are reached?

   ⇒ For each type of data input the system must handle, what is the expected volume?

   ⇒ What number of jobs/transactions is expected per unit time?

- ◆ Memory

   ⇒ Is there a maximum amount of memory utilization for the system?

- ◆ Reliability

   ⇒ Is there a quantitative measure of ability (e.g., number of bugs per unit of code after implementation, time to repair defects, down time, loss of data) of the system to behave consistently in the environment in which it was intended to be used?

   - • Accuracy

      ⇒ Are there acceptable minimums for accuracy?

   - • Availability

      ⇒ What is the required level of system availability by hours per day and days per week?

      ⇒ Are there any time zone impacts or considerations?

      ⇒ What are the time zone impacts of the system?

   - • Timing

      ⇒ Define the response time requirements for software and/or its environment.

      ⇒ What is the allowable time for off-line processes?

   - • Security

      ⇒ Is there need for special handling of data or processing (e.g., warning notices, or security labels)?

      ⇒ Is there a need for logon passwords to gain access to the system?

      ⇒ Is there a need to restrict access to on-line menus?

      ⇒ Is there a need for field-level security?

      ⇒ Is there any need to restrict or control access to data or functions by user or type of user?

Low Level Requirements Identification Checklist

- Survivability

  ⇒ Are there any requirements for this system or data to survive in hazardous conditions or through natural disasters?

System Characteristics

♦ Efficiency

  ⇒ Is there any minimum level at which the system should use scarce resources?

♦ Flexibility

  ⇒ Will the system be greatly affected by changes in the business processes such that it needs to be quickly and easily modified?

♦ Maintainability

- Life Span

  ⇒ What is the intended lifespan of the system?

- Modifiability

  ⇒ What is the maximum module size?

  ⇒ What is the maximum code complexity level?

- Reusability

  ⇒ Are there requirements for using off-the-shelf or reusable software?

- Understandability

  ⇒ Is there a certain language or family of languages to be used to enhance understanding of the code, and thus enhance the modifiability?

  ⇒ Are there coding standards to be adhered to?

- Upward Compatibility

  ⇒ Are there any requirements for upwards compatibility for any system or version software components?

♦ Portability

  ⇒ Is there any need for the software to be developed under one host computer environment and be easily converted to run on another host computer environment now or in the future?

Low Level Requirements Identification Checklist

Operational

♦ Audit Capability

⇒ Is there a need to maintain a system log?

♦ Help

⇒ Is on-line help a requirement?

⇒ At what level (i.e., screen, field)?

♦ Recovery

⇒ Is there a need for system backups?

Other

♦ Conversion

⇒ Is there any need to convert existing data or processes to another environment?

⇒ What is the frequency of data conversion?

⇒ What is the estimated record volume per input file?

♦ Interface Requirements

⇒ Is there a need to handle or generate the data to be passed to interfacing systems or hardware devices?

⇒ What are the data transfer requirements (volume, frequency, accuracy)?

♦ Internationalization

⇒ Are there any cultural/language considerations for the user interface or system functionality (e.g., monetary, time, terminology)?

♦ Human Factors/Usability

⇒ Have you defined the user interface such that there is no doubt in the designers or the customers mind what is to be built?

Low Level Requirements Identification Checklist

- Products

  ⇒ What are the agreed upon deliverables, documentation or other products or services to be delivered (e.g., Training)?

- Delivery Dates

  ⇒ Are there any mandatory or target dates for delivery of deliverables, documentation, or other products?

  ⇒ Are there any mandatory or target dates for completion of the project or any phases of the project?

- Milestones

  ⇒ Are there any important milestones for project reviews, testing, or senior management briefings that must be met?

- Resources

  ⇒ Are there any constraints on or requirements for resources (e.g., budget, staff, or other) to be used?

5.0 APPENDIX B – RDM IMPACT ANALYSIS

Impact Analysis

The project change control group receives a systems change request.
A designated element of the project evaluates the change request for its impact on the system being acquired. If the change is going to occur then changes in commitments are negotiated
The change process is monitored.

Receive systems change request	
Appraise change impact on	Performance
	Architecture
	Supportability
	System resource utilization
	Contract schedule
	Cost
Negotiate commitment to	Groups external to SFA
	SFA
Change system acquisition plans, work products, services, or activities	Identify
	Appraise for impact
	Analyze for risk
	Document
	Communicate to affected parties
	Track to completion

6.0 APPENDIX C - RDM MEASUREMENT AND ANALYSIS

Objective and Scope

This document has four purposes that will assist in the management of requirements:
- Provides a definition for Measurement and Analysis level 2 key process area requirements development and management (KPA RDM).
- The purpose of measurement and analysis
- The usage of measurement and analysis
- Examples of measurements

Measurement and analysis (M&A) is a common feature of key process area, requirements development and management (KPA RDM). M&A is a best practice to assess that requirements are developed and managed effectively. The reader should gain an understanding of measurements and analysis practices that aid with completing the goals of KPA RDM.

Definition

Measurement and analysis (M&A) describes the need to measure processes and analyze measurements. These measurements can be both quantitative and qualitative to assess the progress of RDM. M&A includes examples of the measurements that could be taken to determine the status and effectiveness of the activities performed.

Purpose

Measurements are made to determine the status of RDM activities and resultant products. Measurements support the goals of RDM by monitoring the progress of activities to attain those goals. The insights gained through an analysis of these measurements can be used to improve the existing RDM process and to provide historical data for use in future planning efforts. Additionally, these measurements can be analyzed to identify potential risks or trends affecting the project or to determine the project's progress.

M&A is one of the attributes that aid as an indicator to evaluate whether the implementation and institutionalization of a key process area can be effective, repeatable, and lasting. M&A activities include identification of the venue, tool, or process used to measure RDM processes and product requirements. These measurements are collected as data via one of the above-mentioned channels by piloting, implementing, and usage of the mechanism selected to gather data. The data is analyzed and results are reported, subsequently taking the necessary actions to improve performance. There are various software tools available to gather requirements. The recommended Student Financial Assistance (SFA) Enterprise software tool for requirements gathering is Rational's Requisite Pro. At a project level, requirements can be captured in word processing software, e.g. Microsoft Word or in a spreadsheet format, e.g. Microsoft Excel. If the project has maintained a requirements database, many of the metrics can be generated without much effort.

Examples:

It is recommended that measurements be collected on the following:

- Number of requirements identified per Solution Life Cycle phase
- Number of requirements by category
- Number of issues related to a requirement per SLC phase
- Duration of open issues per requirement (by week, per phase)
- Number of Change Requests per requirement and per SLC phase
- Number of approved Change Requests per requirement
- Number of requirements reviews conducted

Additional Measurements:

- Compare actual hours allotted for developing requirements vs. estimated hours
- Compare actual funds allotted for developing requirements vs. estimated funds
- Monitor the variance in schedule changes towards completion of RDM planning (status reporting, due date changes or extensions, etc)
- The identification and documentation of initial system requirements

See Table 6.1 Requirements Measurement Matrix

Table 6.1 Requirements Measurement Matrix

Requirements Measurement Matrix Example

#					REQUIREMENT CHANGE STATUS					
	REQUIREMENT	WORK HOURS		CHANGE REQUEST #	CRITICAL		ACCEPTED	ADD	DELETE	DEFERRED	REJECTED
		Estimated	Actual		Yes	No					
	High Level										
	Low Level										

Note: This is an example of a detailed requirements measurement matrix. The point person for this activity has the ability to customize the table to fit the project need. Project will vary and may not need or desire to all of these measurements capture. It is recommended to capture measurements that are easy to gather but produce valuable insight when analyzed.

7.0 APPENDIX D – REQUIREMENTS TRACEABILITY MATRIX

Systems Requirements Traceability Matrix Examples

Detailed Requirements Matrix created in a spreadsheet.

System Requirements Traceability Matrix								
EXAMPLE								
	Reference	*<<requirements are categorized by topic, subject, etc>>*	**Business Needs**	*<<Business Needs, imported from Business Case>>*	**Requirements**	*<<Low level requirements, testable>>* **Functional Requirements** *<<Exact item or outcome system testing will verify>>*	**System Component** *<<System component that meets that requirement>>*	**Welcome Page** **Login Page** **Registration Page**
Category			**High Level**		**Low Level**			
Integration								
	1.2.2		Easy software integration					x
	2.3.3							
Portability								
	4.1.2		Ease of transfer					x

Basic Example created in a word processing document.

High-level Functions - Requirements Traceability Matrix			
Project Name: Date: Last Revision Date: Completed by:			
High-level Function	Requirement Number	Requirement Title	How function is Satisfied

8.0 APPENDIX E – PEER REVIEW PROCEDURE

8.1 Schematic

```
┌──────────┐     ┌──────────┐     ┌──────────┐     ┌──────────┐
│Prepare for│ ──▶ │ Conduct  │ ──▶ │ Perform  │ ──▶ │ Analyze  │
│  Review   │     │  Review  │     │Necessary │     │  Review  │
│          │     │          │     │  Rework  │     │ Results  │
└──────────┘     └──────────┘     └──────────┘     └──────────┘
```
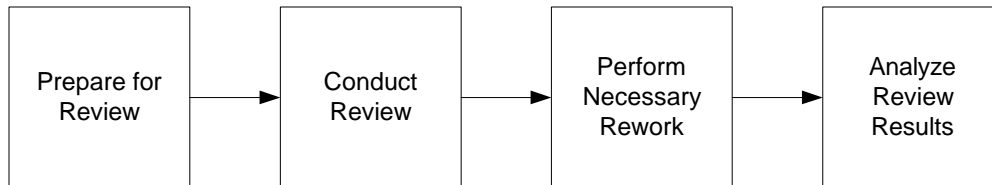
Description

    The Peer Review Procedure describes the examination of products by peers in order to identify improvements and to make needed changes.

Benefits

- A change determined early in the development cycle can be as much as 100 times cheaper than the cost of a later revision.

- Peer reviews are common throughout the IT industry, and regularly have a 12:1 Return on Investment. This means every hour spent identifying and removing errors; 12 hours of future work are avoided.

Inputs
- Draft product in the final stages of preparation.
- Standards documentation.

Output
- Reviewed product.

Outcomes
- Reduce time and costs resulting from rework
- Documentation of meeting.

8.2 Schematic Description

Activity	Responsibility
Step 1: Prepare for Review - **Budget time to conduct Peer Reviews.** - **Determine Peer Review standards and criteria**	**Project Manager and Team Lead**
- **Schedule a mutually agreeable time for the Peer Review with the Peer Reviewer(s)** - **Identify and contact necessary participants (review duration >= 2 hours)** - **Organize logistics** - **Give materials and standards to Peer Reviewer(s) to review, minimum 3 business days before review takes place**	**Deliverable Owner**
- **Prepare and read through materials beforehand** - **Bring document comments and recommendations either in electronic or written form**	**Peer Reviewer**

Activity	Responsibility
Step 2: Conduct Peer Review - Document defects, issues, risks, and action items - Record meeting minutes - Record time spent on Peer Review	**Deliverable Owner**
- Engage a moderator to instruct participants and facilitate the discussion - Share recommended comments and changes to the deliverable with its owner - Confirm that all issues are documented - Collect metrics from participants - Schedule follow-up session, if needed - Record time spent on Peer Review	**Peer Reviewer**

Activity	Responsibility
Step 3: Perform Rework - Perform necessary rework as recommended by the Peer Reviewer(s) - Collect Peer Review metrics including the time spent preparing for and participating in the Peer Review, number of defects, and other metrics deemed necessary by the Team Lead - Monitor status of defects, issues, risks, and action items - Document time spent on rework to measure savings - Project lead to review rework - Verify actions are closed - May need to reschedule Peer Review	**Deliverable Owner**

Activity	Responsibility
Step 4: Analyze Peer Review Results Periodically - **Submit Peer Review metrics to Project Manager for analysis**	**Team Lead**
- **Analyze Peer Review metrics** 1) Analyzing the metrics resulting from Peer Reviews is a requirement of the process, consistent with CMM requirements. 2) Analysis to focus on the number of defects, where they occurred in the process, and what stage in the process the defects should have been detected (e.g., a large number of defects for a functional requirements document might indicate that the project scope was not clearly defined, or that the change control process is not effective). - Evaluate project execution of the Peer Review process 1) Although the results of Peer Reviews can be used to identify areas for process improvement, they should never be used in performance evaluations. This might stifle communication and render the Peer Review process ineffective. 2) Corrective action involves taking the necessary steps (resources, training, etc.) to prevent the same types of errors in the future. - Identify areas for Process Improvement or areas where corrective action may be necessary.	**Project Manager**

9.0 APPENDIX F - LOW LEVEL REQUIREMENTS APPROVAL DOCUMENT

<<Insert Date of Document Here>>
Department of Education
Student Financial Assistance
<<Insert Contractor Name Here>>

Subject: The undersigned approved the low level requirements as documented in
<<Insert document name>> on *<< insert document date>>*.

* Denotes signatures that are required for document approval.

Low Level Requirements Approval Matrix				
Student Financial Assistance (SFA)				
Position	**Print**	**Name**	**Signature**	**Date**
Executive Sponsor *				
Project Manager*				
Quality Assurance Manager*				
RDM Team Lead*				

NOTE: Emergency change procedures will be documented after the fact. Emergency changes are those that must be corrected within 48 hours in order for the critical functions of the system to perform normally.

10.0   APPENDIX G – RDM PLAN TEMPLATE (Stored Separately Electronically)

NOTE: This document is provided as a physical hardcopy within the process guide. It exists electronically as an external separate document, to provide the user with a more user-friendly template.